

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
23 October 2003 (23.10.2003)

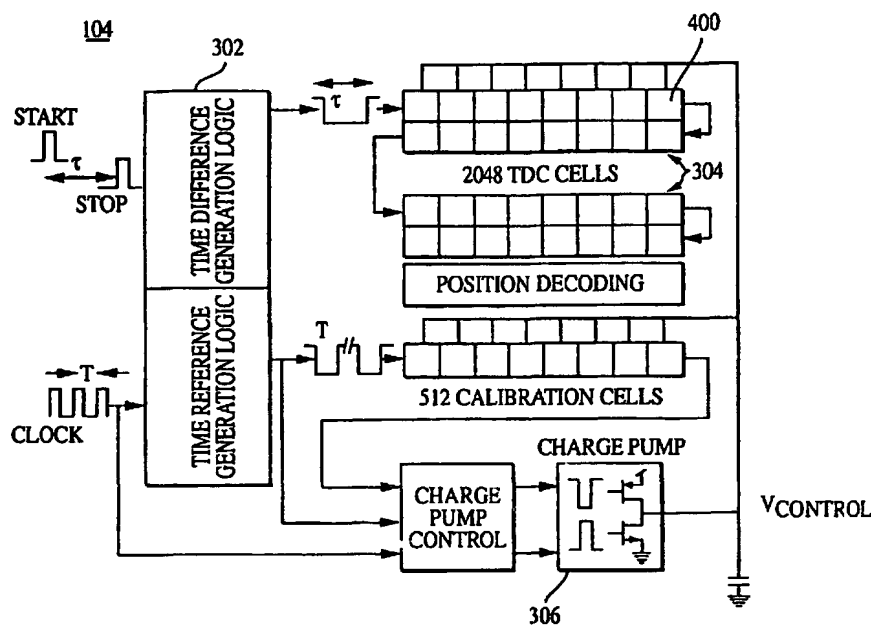
PCT

(10) International Publication Number
WO 03/088485 A1

- (51) International Patent Classification⁷: **H03K 5/13**, 5/159, 3/017
- (21) International Application Number: PCT/US03/11205
- (22) International Filing Date: 10 April 2003 (10.04.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data: 60/371,506 10 April 2002 (10.04.2002) US
- (71) Applicant (for all designated States except US): **THE JOHNS HOPKINS UNIVERSITY** [US/US]; Applied Physics Laboratory, 11100 Johns Hopkins Road, Laurel, MD 20723-6099 (US).
- (72) Inventor; and
- (75) Inventor/Applicant (for US only): **PASCHALIDIS, Nicholas, P.** [GR/US]; 604 Stone House Lane, Silver Spring, MD 20905 (US).
- (74) Agents: **ROCA, Benjamin, Y.** et al.; The Johns Hopkins University, Applied Physics Laboratory, 11100 Johns Hopkins Road, Laurel, MD 20723-6099 (US).
- (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published:**
— with international search report

[Continued on next page]

(54) Title: THE TIME OF FLIGHT SYSTEM ON A CHIP



(57) **Abstract:** A CMOS time-of-flight "TOF" system-on-a-chip "SoC" for precise time interval measurement with low power consumption and high counting rate has been developed. The analog and digital TOF chip may include two Constant Fraction Discriminators "CFDs" and a Time-to-Digital Converter "TDC". The CFDs can interface to start and stop anodes through two preamplifiers and perform signal processing for time walk compensation (110). The TDC digitizes the time difference with reference to an off-chip precise external clock (114). One TOF output is an 11-bit digital word and a valid event trigger output indicating a valid event on the 11-bit output bus (116).